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UNITED STATES DEPARTMENT OF AGRICULTURE

# FOREST SERVICE

CALIFORNIA FOREST EXPERIMENT STATION
D-5

RP
Lumbering
Woods & Mill Study
Pickering Lumber Co.

WORKING PLAN

for

WOODS AND MILL STUDY

at

PICKERING LUMBER COMPANY, STANDARD OPERATION

STANISLAUS NATIONAL FOREST, D-5

by

M. R. BRUNDAGE
Associate Forester in Forest Products

March 30, 1929

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Copy for information of J. M. Miller

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District 5

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Members of Office of Forest Management, D-5
and other cooperating agencies

March 30, 1929

(Approved copy filed at California Forest Experiment Station)

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WORKING PLAN
for
WOODS AND MILL STUDY TO BE CONDUCTED IN 1929
by the
CALIFORNIA FOREST EXPERIMENT STATION, U.S.FOREST SERVICE
AND COOPERATING AGENCIES
On the Operations of the
PICKERING LUMBER COMPANY, STANDARD, CALIFORNIA

- -

PART I

## GENERAL DESCRIPTION, PURPOSE AND ORGANIZATION OF PROJECT

### Location of Project

This study, which will provide for the first time in District 5 an actual correlation between standing individual trees and their comparative values for lumber production, will be conducted in the following localities:

1. Woods study on government owned virgin timber land (Pickering Lumber Company sale area) in the Stanislaus National Forest. The area is centrally located in the commercial timber belt of the west side Sierra Nevada and the stand is typical of that found on the better sites of this region.

2. Mill study at the Pickering Lumber Company's plant in Standard, about 30 miles from the logging area and connected thereto by the company's privately owned, standard gage railroad. It is a double band mill with a daily output for two shifts of about 320 M feet. The annual production is 75 to 85 million feet.

The Stanislaus National Forest is one of the principal centers of work of the California Forest Experiment Station. Several permanent plots have already been established there

and the location in the same vicinity of the plots called for by this study will materially expedite the making of future periodic observations by the Office of Silvicultural Investigations. The area is favorably situated with respect to the District Office and Experiment Station headquarters, being within one day's travel by automobile. The timber stand typifies the general average for the region. The Forest itself has for several years been a leader in volume and value of annual timber sales. For these reasons the opportunity of locating the initial District 5 project of this type within such a convenient and important center of research and lumbering activities has been particularly fortunate.

Woods Area and Study Plots

The woods area within which the logging plots will be selected, is on moderately sloping ground suitable for tractor logging. The elevation is approximately 5800 feet. The commercial species are:

Sugar pine - - - - - - - -Pinus lambertiana
Western Yellow pine - - -P. ponderosa
White fir - - - - - - - -Abies concolor
Incense cedar - - - - - -Libocedrus decurrens

The stand is all-aged, about 80% mature and over-mature with approximately 60 M feet to the acre in trees 12" DBH and over. Records of nearby sales on areas of similar character show the timber removed by standard Forest Service marking practice to run between 2 and 2½ logs to the thousand feet, and from 6 to 7 logs to the tree.

Four plots of approximately 20 acres each will be established for a comparison of different systems of cutting. These are as follows:

Plot 1 - To be marked, cut and logged in accordance with standard District 5 Forest Service timber sale practice.

Plot 2 - To be cut and logged according to a heavy cutting system which will remove merchantable material of all species to a low diameter limit including a few trees to the acre in the 12", 14" and 16" classes.

Plot 3 - To be cut and logged in accordance with the practice recommended in an economic selective logging plan prepared in 1928-29 by the firm of Mason & Stevens for another similar locality in the west side pine region. This plan calls for the leaving of practically all fir and cedar and the leaving of pines below a diameter limit of around 30 inches, more or less, depending on the character of the border-line trees.

Plot 4 - To be cut and logged according to a new policy to be put into practice this year by the cooperating company on their private lands. Under this system no fir will be cut and pines 16" DBH and under will be left.

The four plots will be contiguous if an area of about 80 acres of sufficient uniformity can be found. In any event, Plots 1 and 2 will be adjacent to each other. Further details are given under "Selection of Plots". These four subdivisions will be referred to hereafter by number only or as the "Forest Service standards plot","heavy cutting plot", "economic selection plot", and "Pickering Lumber Company plot", respectively.

In all previous discussions concerning proposed working plans, it was assumed that any one plot would be considered only from the standpoint of the particular cutting system which determined the number and character of trees actually to be removed from it. From the comparative silvicultural values to be established by periodic observations of the permanent sample plots, this is truly the paramount idea. It is, in fact, the raison d'être of the decision to cut according to the different systems. From the standpoint of comparative economic values, however, and for immediate use in approximating the probable comparative silvicultural values by the application of information already derived from other sources, we believe it will be well worth while also to designate on at least three plots the trees which would be cut under each of the systems mentioned above. We will then obtain a record of the trees, log grades, etc., which would be yielded by each method over a tract of 60 acres, thereby tripling the volume of data on which to base the comparisons and at the same time removing the awkward variable of the inevitable differences between the original stands on each plot. It is hoped that the company's representative and Mr. Mason will be able to devote the few extra days necessary for designating the trees which should be removed under their respective methods of cutting on three of the plots before the Forest Service crews proceed with the marking, numbering, classifying and log grading jobs.

The quantity of timber from the study area to be definitely correlated on an entire tree basis with the yield of lumber by volume and grades should be about 1,500 M feet B.M. Allowing for possible over-estimating and unavoidable losses, this means that approximately 1,700 M feet B.M. should be designated for inclusion in the mill study. We plan to obtain the desired volume from Plots 1 and 2. Felling, limbing, bucking, yarding and possibly loading studies will be made as far as possible on Plots 3 and 4, but the trees cannot be followed through the mill because the mill study crew will probably be disbanded before these plots are logged.

Character of Project and Miscellaneous Considerations

The central idea of the project, as expressed in the first sentence of this working plan, and described in greater detail under "Purpose" and "Objectives" is the determination of comparative actual values, as differentiated from calculated or reconstructed values, of the widely varying individual trees found in the virgin stands of the region. The value difference between tree classes, especially, is an important consideration about which we now know little or nothing. The values calculated from taper curves and log grades taken in the standing tree, have never been checked in District 5.

There have been several independent studies of woods costs on a log diameter basis, two or three on a tree diameter basis, and there is some information available on the comparative costs of sawing logs of different diameters. The Office of Forest Management has conducted several mill scale studies showing the comparative yields of lumber by grades for logs of different

diameters, species and log grades. The log grading, however, has always been done only on the mill deck. How does the latter compare with the grading in the standing tree? We do not know. There has been no correlation whatever between woods information and mill information other than that obtainable by mathematics necessarily based on certain assumptions.

Other Districts of the Forest Service and the Forest Products Laboratory have lately undertaken tree-to-lumber studies and we are indebted to them for the benefit and guidance which their plans and reports have provided in the planning of our own initial project of the same general character. The usual procedure of referring by number to all reports and other literature which have been reviewed prior to the preparation of this working plan has not been followed because of the "rush" nature of the latter job.

There was no assurance that such a project could be undertaken until the last of January of this year, although the director of the Station has been trying for some time to invoke the cooperation of various pine operators. Officials of the Pickering Lumber Company have recognized the value of this type of investigative work, but hesitated before in assuming the responsibilities of cooperation due to certain apparently insurmountable difficulties in connection with working out a scheme whereby a high percentage of tree-mill correlation would be assured for the study plots.

Without going into details, suffice it to say here that the only feasible plan which will guarantee against the loss of so many study logs that the primary purpose of the project would be defeated, or which will not call for impracticable changes in the company's regular methods of woods switching, making up trains, transportation, dumping in the pond, delivery to the slip and allocation of logs to the two headsaws, lies in placing sufficient study crew personnel in the mill to follow the output of both sides day and night. The average volume to be yarded daily from the study plots by the operator's tractor logging unit of five Caterpillars and a loading crane - estimated at about 125 M feet - will be only 39% of the sawmill's daily production for two shifts. This will come in on two daily trains but lack of pond storage facilities and the larger volumes of other logs with which the study material will be mixed at the time of unloading, thus making complete segregation extremely difficult, will divide the daily run of woods-study logs probably about equally between the day and night shifts.

Practically the entire output of the mill while the study is in progress will be scaled, tallied, and grade marked. Tree correlation will, of course, be impossible with the 61% of output coming from areas other than the study plots but the additional data will be of great value in strengthening the log-diameter-species-grade curves for sawing time, those

showing comparative losses in sawing, edging and trimming, and in giving a high degree of accuracy to the tables showing the relative proportions of the various grades of lumber obtainable.

Perhaps the most important feature connected with the tally of total output for both shifts, however, is that it will promote maximum efficiency in the seasoning degrade study. If not any but the study logs were tallied, the lumber would be so widely scattered through that which was not grade marked by the study crew graders, both in the kiln cribs and the yard piles, that a reliable check on the accuracy of original green chain grading would be next to impossible.

All statements made in this plan relative to purpose, objectives, costs, values, etc., apply only to the west side pine region of California, so named because of its location in reference to the Sierra Nevada divide. The east side pine region in the northeast portion of the State is fundamentally different in character and will require a separate logging and milling study for the solution of the problems peculiar to its own local conditions.

The "classes" or "Thrift classes" of trees referred to in the plan are those devised by Dunning in his "A Tree Classification for the Selection Forests of the Sierra Nevada" published in the Journal of Agricultural Research, Vol. 36, No. 9.

Purpose:

Primarily to establish a more definite correlation between the economic and silvicultural considerations involved in the management and utilization of timber stands in the California pine region. For each commercial timber species, the relative actual values, relative costs of production, and waste in conversion, for sound and defective trees of different diameters and different thrift classes will be determined. Information will be secured pertaining to forest regeneration, rate of growth of trees left, damage from logging and attrition from diseases, all of which vary more or less according to size, age, thrift, and species of trees composing the stand and according to the practices followed in cutting and removal.

This accumulation of definitely correlated facts will provide evidence for a clearer judgment of the silvicultural and economic efficacy of present Forest Service and private practices in the region studied and a comprehensive basis for the formulation of revised policies and recommendations wherever revision is shown to be desirable and feasible.

Objectives:

Fulfilling the primary purpose of this project calls for the setting up of several clearly defined objectives referring particularly to the kinds of data required. The methods which must be followed in the study and the large project crew personnel which must be assigned to the work in order to

guarantee a high percentage of efficiency in tree-lumber correlation(i.e., a satisfactory percentage of positive identification and follow-through of entire trees from stump to lumber sorting table) makes it possible also to provide additional information bearing directly on scaling methods, utilization, the white fir problem and other matters of immediate interest to the lumber industry and those engaged in various lines of forest research or administration. The subdivisions of the latter are also set up as definite objectives, though they might be considered technically as non-essential to the main requirements of the project as defined under "Purpose".

The objectives are, to determine:

1. The comparative labor and other items of expense involved in each step of logging and milling, from stump to lumber sorting table, for -

   (a) Logs of different species, sizes, grades, and degrees of merchantability and from different thrift classes of trees and different positions in the tree.

   (b) Sound and defective trees of different species, sizes, and thrift classes.

2. The comparative yields of merchantable lumber by grades and sizes actually cut from logs and trees as outlined under (a) and (b), objective #1, above.

3. For the operation studied, the diameters of trees of different species and classes below which conversion into lumber becomes unprofitable.

4. The comparative merits of the four cutting systems previously defined, insofar as possible, from the standpoints of:

   (a) Immediate net profits realizable on an M foot basis and on an acre basis.

   (b) Probable number of years which must elapse before a second cutting will be feasible.

   (c) Probable future value of the cut-over lands for continuous operation of the established plant, taking into consideration the third and subsequent cuttings as well as the second cutting cycle.

5. The correlation between:

   (a) Size, age, thrift, and external evidences of disease and the merchantability of trees of each species.

   (b) The external evidences of decay and the merchantability of logs of different species, sizes, and positions in the tree.

   (This objective is dependent on the special study to be made by the Office of Forest Pathology)

6. The per cent of off-grade in the green chain grading as done in connection with the study, i.e., the percentages of the volumes of each green chain grade which should have been placed originally in higher or lower grades. No check has ever been made on the accuracy of mill study green chain grading in this District.

7. The degree of accuracy in standing tree log-grading by comparing the woods grade with the mill-deck grade assigned to each log from the study plots.

8. A basis upon which to formulate more easily applied descriptive terminology for log grading rules.

9. The kinds and amounts of wood material which are lost:

   (a) In felling, limbing, bucking, and yarding operations.

   (b) Due to unavoidable breakage.

   (c) In sawing, edging and trimming.

   (d) Chiefly because of economic considerations such as the lack of a market, excessive costs for removal from the woods, or the unprofitableness of more intensive utilization in the sawmill.

10. The amount and value of seasoning losses and degrade for each original green chain grade of each species. This will include both kiln-dried and air-dried material.

11. The validity of the complaints against white fir timber with reference in particular to underrun, frequency and kinds of hidden defects, merchantability of coarse top logs, and seasoning losses. In this connection special effort will be made to segregate seasoning losses and degrade chargeable directly to compression wood.

12. The possibility of judging with a fair degree of accuracy the thrift classes of the trees from which logs are cut and the positions of the logs in the trees solely from the characteristics of the logs as they appear on the mill deck. This is of importance in the conduct of future mill scale studies. If results obtained in this study show that such estimates may be made with reasonable accuracy, it is apparent that a great deal of expense and trouble can be eliminated in carrying out similar analyses on other operations through elimination of the necessity for synchronizing the woods studies with the mill studies.

Additional Information

The possibilities of making special combinations and segregations of data to provide information which will aid in the solution of forest management problems other than those described under objectives can be better determined after the study is completed.

Aside from the specific information called for on the field forms, the men in charge of each activity phase of the project will take notes on anything else which might have a direct or indirect bearing on costs, values, degree of utilization in woods and mill, and the feasibility of improving or revising customary practices to secure greater returns from the same trees.

The San Francisco Office of Forest Pathology, which has already been mentioned in connection with objective #5, plans to take advantage of the opportunity offered by this study to follow selected trees - the ages, classes, rates of growth and pathological descriptions of which have been recorded in the woods - through the opening up process at the headsaw. The positive correlation of individual tree and log characteristics and their external evidences of decay with the relative actual losses of merchantable material from fungi, made possible by this method, will provide information of considerable value to silvicultural research workers, timber sale officers, cruisers, appraisers and scalers. Dr. E. P. Meinecke has prepared a plan of work for the cull studies in line with the methods of specialized forest pathological research.

Research workers with the U. S. Bureau of Entomology, one of whom, H. L. Person, is connected with the Experiment Station, plan to make surveys of insect damage on the woods plots before and after cutting. From the results of their work it may be possible to correlate the merchantability of infested trees with the period which has elapsed since the initial attack, the severity of attack and the species of insects responsible for the damage. Their work will also be of value as a complement to the silvicultural studies.

The Office of Blister Rust Control plans to make a survey of Ribes on the three plots before logging, and to follow the changes resulting from cutting. Eradication experiments have already taken place over the area within which the study plots will probably be located.

The Office of Range Management, District 5 headquarters, will determine the kinds and amounts of forage cover following the different cutting systems and secure other information relative to grazing regulation and values.

The Forest Products Laboratory, Madison, Wisconsin, may send a technologist to undertake special investigations of white fir compression wood but at this writing the possibility of arranging such a detail is rather indefinite.

## Cooperating Agencies

Following is a list of all cooperating agencies which will take part directly in one or more phases of the logging and milling study proper or in special studies to supplement their own respective lines of research, or in both.

### U. S. Government

California Forest Experiment Station, U. S. Forest Service, Headquarters Berkeley.
Office of Forest Management, District 5 Headquarters, U. S. Forest Service, San Francisco
Office of Range Management, District 5 Headquarters, U. S. Forest Service, San Francisco
Stanislaus National Forest, Headquarters Sonora
Sierra National Forest, Headquarters Northfork (will assign one scaler for the mill study)
Forest Products Laboratory, Madison, Wisconsin
Office of Forest Pathology, U. S. Bureau of Plant Industry, Headquarters San Francisco
Office of Blister Rust Control, U. S. Bureau of Plant Industry, western headquarters at Spokane, Washington, with branch office in Berkeley
Office of Forest Insects Investigations, U. S. Bureau of Entomology, Headquarters of the California Branch of the Bureau at Palo Alto, with one man assigned to California Forest Experiment Station.

### State of California

Division of Forestry, University of California, Berkeley

### Private

Pickering Lumber Company, Standard, California operation. Headquarters in Kansas City, Missouri.
California White and Sugar Pine Manufacturers Association, Headquarters San Francisco (Lumber graders for mill study)
D. T. Mason of Mason & Stevens, Forest Engineers, main office in Portland, Oregon, with branch office at San Francisco.

## Organization of Project Work and Responsibilities of Each Agency

The California Forest Experiment Station will be in general charge of the entire project. With so many agencies involved, the earnest cooperation of "each for all and all for each" is essential to insure the success of the undertaking. Final authority and the preparation of the general plan must be centered in some one agency, however, and these fall naturally to the Experiment Station because of their heavy investment of funds and personnel in every phase of the project.

The responsibilities of the Station include:

1. The coordination of the various agencies involved.
2. The making of all arrangements with the cooperating company for the accommodations of the study crew personnel.
3. The hiring of all temporary field assistants and arrangements for the assignment of those members of the various crews who are to be loaned by the other agencies.
4. The printing or mimeographing of all necessary forms other than those to be supplied by the University Forestry Division.
5. Arrangement with the cooperating company of all matters pertaining to the latter's conduct of the woods, railroad and mill operations, and the allocation of stock for the seasoning degrade studies.
6. All silvicultural studies on the woods plots including surveying and mapping.
7. The classification, description, measurements, and numbering of all trees 12" DBH and over on the study plots.

8. The felled tree analysis records.

9. Survey of logging damage.

10. All details of the milling study with the exception of log grading and scaling.

11. The study of seasoning degrade.

12. Securing information from the operator in respect to wage scales, general expenses, depreciation, instructions to woods workers, sawing instructions, selling prices, etc., necessary for the application of the study data to his operations.

13. The computing and analysis of all tree volume, mill scale study, and seasoning depreciation data.

14. Organizing the information from all sources into a combined coordinated report.

The Division of Forestry of the University of California, represented in the study by M. E. Krueger, Associate Professor of Forestry, will be responsible for:

1. The assignment to the woods studies of one assistant, in addition to the faculty member named above. The balance of seven or eight men needed to complete the woods study crew will be secured by the Experiment Station.

2. Supplying the forms for the log-making, yarding, loading, and transportation cost studies.

3. The time studies of felling, limbing, bucking, yarding and loading.

4. The recording of the study logs placed in each car load.

5. The computation and summarizing of all woods operation time study data, and the individual car load records, the results of the latter to show the comparative costs of transporting logs and trees of different species and sizes.

6. The preparation of summary tables and curves for the studies described above and a written description and analysis to be included in the final report as a section on log making, yarding and transportation.

The Office of Forest Management, District 5 Headquarters, will be responsible for:

1. The marking of trees to be cut on Plot 1 (Forest Service standards plot). This marking will be done cooperatively by members of the above office, the Experiment Station, and the Stanislaus National Forest, but the final decision in case of disagreement will rest with the Chief of Forest Management.

2. The grading of logs on all plots.

3. The assignment of six men from the D-5 timber survey crew for active participation in the mill scale study from July 7 to July 28, the salaries of the six for this period to be paid by the Experiment Station together with travel and subsistence expenses.

4. The grading and supervision of scaling of all logs on the mill deck during the period of the milling study.

5. The formulation of revised log grade descriptions based as far as possible on readily visible characteristics and depending less on the judgment of the log grader.

The Stanislaus National Forest will be responsible for:

1. The cooperation in the mill study of their two scalers stationed at Standard to scale timber from sale areas. Their regular scale book entries can be made as usual or copied from the study forms later so that there will be no interference with the duties for which they are employed by the Forest.

2. Supervision of the felling, limbing, bucking and yarding operations on Plot 1 to see that they conform to standard sales practice.

3. Keeping a record of the man-hours and costs involved in brush disposal on each plot and supervising these activities to see that they conform either to standard practice or to other rules which may be decided upon later.

The Sierra National Forest will be responsible for:

1. Assigning one man to the project for scaling during the period of the mill study. It is now planned to have W. V. Jones detailed for this work.

The Office of Forest Pathology will be responsible for:

1. All special pathological investigations in woods and mill.

2. The correlation of the milling study data with their special tree and log observations.

3. The preparation of a report to be combined with the final one for the study as a whole.

4. The preparation of special information regarding the practical application of their findings to marking, sanitation, utilization requirements and scaling on timber sales.

The representative of the Bureau of Entomology will be responsible for:

1. Recording the details of insect infestation by tree numbers so that they can be correlated with the mill study data.

2. Following the progress of infestation on the four plots after cutting.

3. The preparation of a special report for inclusion in the one for the project as a whole, if desirable, or of written information which may be correlated with the other data.

The Office of Blister Rust Control will be responsible for all work in connection with their proposed survey of the amount and kinds of Ribes on the woods plots, the examinations of the areas after logging, and the preparation of reports pertaining thereto.

The Office of Range Management will be responsible for conducting all field work and preparing reports in connection with grazing investigations on the woods plots.

The Pickering Lumber Company will be responsible for:

1. Arranging their logging plans so that all operations on the selected plots will fit in with the general scheme of progression outlined herein.

2. Providing board and such other accommodations for the woods and mill study crew personnel as may be agreed upon between the company and Experiment Station representatives, such accommodations to be paid for at the usual rates charged by the operator.

3. The designation of trees on all four plots which would be cut under their standard system of logging on company land.

4. The assignment of fallers, buckers, and limbers to the plots according to the arrangements specified under "Conduct of Field Work" - "Felling, Limbing and Bucking".

5. The yarding and loading of logs from the study plots in accordance with the procedure given under "Conduct of Field Work" - "Yarding", and "Loading".

6. The transportation to the Standard Mill of all study plot logs as promptly after yarding as the regular railroad schedule will permit. (The last study logs should be in the pond, if possible, the day after completion of the woods study operations.)

7. Assigning one man on each shift for the "herding" of the study logs and especially to see that none is yarded to the storage deck by mistake.

8. The handling of the study logs in the pond so that they can be forwarded in an orderly manner to the slip promptly after unloading with the least possible scattering and without misplacement or loss other than from irrecoverable sinkers.

9. The reduction of sinker losses by taking whatever precautions are possible to facilitate the prompt recovery of those study logs which are too heavy to float. In this connection it should be emphasized that the loss of one sinker log usually means the loss of actual correlation for an entire tree; also, that the recovery of white fir sinkers is even more important for the purposes of this study than the recovery of pine.

10. Instructing the company scalers at the head of the log slip to cooperate with the study crew scalers and log graders in every way practicable, without hindering the steady delivery of logs to each headsaw, so that the deciphering of obscure woods numbers, and the necessary measurements and inspections may be accomplished efficiently.

11. Supplying one man on each shift to assist the graders in turning heavy boards on the green chain.

12. Supplying one experienced shipping grader on each shift for the green lumber inspection and tally.

13. The segregation and allocation of lumber to reserved foundations in the drying yard for the air seasoning degrade study.

14. Assigning expert lumber graders for the kiln and yard degrade studies if they are needed in addition to the association graders.

15. Furnishing information regarding wage scales, cost figures of all kinds, lumber selling prices, and other details necessary for the application of the study data to their operation.

The California White and Sugar Pine Manufacturers Association will be responsible for the assignment of two lumber inspection graders to the mill study for grading on the green chain during the period July 8 - 25 (approximate dates, subject to slight changes), and one of the same graders for the kiln degrade study (probably July 26 - 31) and the air seasoning degrade study (in September). The salaries and expenses of these graders will be paid from the project funds.

D. T. Mason of Mason & Stevens, will be responsible for designating the trees to be cut on Plot 3 (economic selection plot), and also those trees on Plots 1 and 2 which would be cut under the same system.

Synopsis of Study Procedure as a Whole

Before outlining the detailed procedure for the conduct of each job, a brief description of the entire study showing the order of work and the relationship between each activity phase from start to finish, will be helpful in establishing a clearer conception of the project as a whole.

The study plots will be selected as soon as weather conditions permit the company to begin woods operations. Following the preliminary location of approximate boundary lines around an area of about 80 acres, a definite dividing line between subdivisions #1 (Forest Service plot) and #2 (heavy cutting plot) will be established between the railroad and the back line of the plots. A company representative and Mr. Mason will then designate the trees which would be cut under their respective methods over the entire preliminary area and the designating of trees to be removed under the heavy cutting system will also be accomplished. The Forest Service crew will then proceed with the final boundary adjustments and the marking, numbering, measuring and classifying work, showing on the field forms what trees would be cut on Plots 2 and 3 under Forest Service marking practice.

On Plot 2 the trees to be cut in accordance with the heavy cutting system; on plot 3 the trees designated for removal by Mr. Mason, and on plot 4 the trees to be cut under Pickering Lumber Company practice, will be marked with the standard U.S. marking axe for felling. Plot 1 will be marked

for cutting by a Forest Service crew under the direction of the Chief of the Office of Forest Management (D-5).

Log grading will be done on all plots by the District logging engineer and his assistant, as soon as the trees have been numbered and classified as described above.

The next step is a detailed survey by the Office of Silvicultural Investigations. This will include all mapping and the establishing of three permanent 10-acre plots for future observation of the effects of different cutting methods. The mapping job will be completed, if possible, by the first of June.

Felling, bucking and limbing will be done on all plots between June 1 and July 3 (if possible). A crew of eight men will carry on time studies, one timer to each set of fallers, each bucker and each limber. It may be possible at times for one timer to follow two buckers if the latter are working on adjacent trees. The felling study timers will transfer the tree number tags(metal) from the bole to the top centers of the stumps for later reference and number the butt cuts with crayon. The bucking study timers will number each butt log on the scaling end and all other logs on both ends by marking with crayon on blazes chopped in the sapwood on opposite sides.

After log making, the "Felled Tree Analysis" forms will be filled in with a diagram of each tree showing, in addition to the caliper scale of each log, the location of breaks, forks, length of tops, height of stumps, etc.

Yarding will begin about July 8 with five or six tractors and a loading crane. A yarding study timer will be assigned to each tractor. In addition to his duties as a timer, he will also copy the tree-log numbers on the cut ends of each log to coincide with the numbered blazes as the trees are pulled apart by the tractors.

A loading study timer will be stationed at the landing who will record the time required to place each log on the car, the time consumed in switching, spotting, binding the loads, etc., and the number of the car on which each log is placed so that the average diameters and volumes in each load may be summarized later. He will be assisted by one other study crew member whose first duty it will be to inspect all log numbers for legibility and to re-mark those which are indistinct. He will also measure diameters and lengths whenever opportunity offers.

There being no possibility of storage or booming in the pond at Standard, the mill study must begin as soon as the first logs are received, which will be the day after yarding starts on the study plots. From then on the progression of logs from plots to head saw will be a continuous performance, with half (more or less) of the numbered logs going to the day shift and

the other half to the night shift. This division is brought about by the railroad schedule of two trains a day, each of which will bring half of the daily output from the plots.

The entire run of logs cut by the mill during the period the study crews are on duty will be scaled, graded and tallied. As each study plot log enters the mill, its woods number will be recorded by the scaler on the special log scale form, but the mill numbers will coincide with the order of progression to the headsaws. Even numbers will be used entirely for one headsaw and odd numbers for the other.

The board markers, stationed between off-bearer and edger on each side, will time the cutting of each log by the headsaw, tally the slab waste and mark the boards for identification on the sorting table. Edger and trimmer losses will be tallied by a special observer.

On the sorting table (green chain), two lumber graders and two tallymen will grade and record every board using a separate tally sheet for the lumber from each log. As the first board from each log comes from the trim saws, the log number and species will be entered at the top of the form and each piece will be tallied by thickness, width, length and grade. One grader and one tallyman will confine their attention to the even numbered boards and the other pair will grade mark and tally the odd numbered boards.

After the green lumber study has been completed, a grader and a tallyman (or two of each, if available) will re-grade several cribs of the study boards which have been kiln dried. The original grade, the dry grade, and the cause of degrade, if any, will be recorded for each piece.

Selection of cribs will be made with the aim of securing an adequate representation of each thickness-grade-species combination which is ordinarily kiln dried by the company as a regular practice.

In the air drying yard about 45 pile foundations will be reserved for the study material. When thoroughly seasoned, the lumber on these foundations will be re-inspected for degrade in the same manner as that given above for the kiln dried stock.

Aside from the seasoning degrade and losses, a reliable check on the accuracy of green chain grading will be made possible in connection with the depreciation studies because every board in the study piles and kiln cribs will show the original grade marks of the study crew graders.

A woods-waste survey will be made on the study plots after logging. This will include a tally of all sound material down to 4" DIB by 4' long. The segregations by classes of material will be practically the same as those made by the District 6 Office of Products in their waste study in the Douglas fir region.

A record of logging damage will be secured in connection with a complete re-check of all plots to be made by the Office of Silvicultural Investigations.

It has not yet been decided definitely whether slash shall be piled and burned on all four plots, whether it should be left scattered on all four, or whether the practices commonly employed under each of the four cutting systems shall be followed on the respective plots.

Computation and summarizing of results for separate phases of the project will be divided between the Experiment Station and the Division of Forestry, University of California, with as much assistance from the Office of Forest Management as they are able to give.

The Experiment Station will organize and prepare the final combined report.

## PART II.

## CONDUCT OF FIELD WORK

(with Detailed Instructions for the Performance of Each Job)

### Selection of Major Plots

The following considerations should govern the choice of study plots:

1. The four plots should be contiguous, if possible.

2. The stand should contain a wide range of diameters with an adequate representation of small as well as medium and large trees, and should preferably be made up of about one-third each of western yellow pine, sugar pine and white fir. Cedar is of minor importance and white fir is of major importance. The latter being the "problem species" of the region, it should be given prior consideration in the final location of plots.

3. The stand should be uniform in composition and topography so that all plots will be as nearly alike as possible from every standpoint.

4. The area must be one which can be conveniently reached by the operator in July, 1929.

An inspection of cruise sheets and sale map indicates that the NE 1/4 of Sec. 28 comes nearer to fulfilling the above requirements than any other part of the sale which will be reached this season.

The procedure will be as follows:

1. Select a unit area of about 80 acres, the lower boundary of which will be the railroad track. The location of suitable landings, to be definitely designated by the company's logging superintendent, will largely determine this preliminary selection.

2. Locate a definite boundary between Plots 1 and 2 in such a manner that the logs will not be yarded from one across the other. This means that a landing will probably be the starting point of this internal boundary line and its continuation will be determined by the topography.

3. Make a rough compass survey and cruise all timber 12" and over on the gross area. From the data thus obtained, the remaining plot boundaries may be fixed tentatively - subject to slight changes - so as to encompass as nearly similar stands as possible on all four plots. Final fixation of end, back, and interior boundaries will be accomplished in connection with marking.

Selection of Permanent Sub-plots

For future study of growth and reproduction, a sub-plot of about ten acres will be selected in each of the first three major plots. The cut and leave records and small tree tallies will be summarized and the sub-plot boundaries adjusted to obtain stands representative of the larger areas. The boundaries of the sub-plots will be surveyed and corners witnessed.

Designation of Trees which would be Removed under each cutting system.

As stated previously, comparative economic values of the different cutting systems will be much more reliable if a record is made of the trees which would be cut under each practice over the entire area than if the comparison were to be made only as between plots. It is doubtful, owing to the delay caused by weather conditions, that all four of the plots can be handled in this manner, but we shall probably be able to carry out the plan on the first three areas. How this may

be accomplished is shown by the following instructions relative to tree designation by each agency involved in this phase of the study:

1. All trees which would be felled, if the entire area were to be cut according to standard Forest Service practice, will be designated by the Forest Service marking crew.

2. All trees which would be considered merchantable, if the entire area were to be cut in the same manner as Plot 2, will be designated by an experienced head faller who is thoroughly familiar with the types of trees usually removed by the heavy cutting system.

3. All trees which would be felled, if the entire area were to be cut according to the Mason and Stevens economic selection system, will be designated by D. T. Mason.

4. All trees which would be felled, if the entire area were to be cut according to the Pickering Lumber Company's new private lands practice, will be designated by the company forester, J. V. Wulff.

The designating can be accomplished most easily and with least confusion by attaching small, colored cards to the bases of the trees, a different color to be used for each cutting system with the exception of Forest Service marking on Plot 1 which will be done in the customary manner.

The trees actually to be cut on Plots 2, 3 and 4, as well as on Plot 1, will be marked with the standard Forest Service marking axe when the tags are removed, by the numbering and recording crews.

Marking, Tree Measurements, Tree Classification and Numbering of Trees

Since these activities will be carried on concurrently, they will be discussed together.

During the final marking, each tree 12" in diameter and over will be numbered. The trees marked for cutting will be numbered in a single series for all plots with metal tags at breast height. The trees to be left will be numbered in separate series with crayon on the bark after smoothing with an axe.

The diameters of all trees numbered will be measured at breast height with a steel tape to the nearest tenth of an inch. The merchantable heights in 16-foot logs (8 inch top) will be measured with a Klaussner hypsometer. Enough total heights will be measured in the same way to provide reliable height-diameter curves for each species. (A current diameter tally will be kept by the note keeper to insure data for representative curves.)

The cut and leave will be recorded in an ordinary Forest Service field notebook (F.289) as follows:

The first page of the notebook will be headed -

RS, MC - Stanislaus. Plot____. System____. Date_____

Cut

| No. | Sp. | DBH | Logs (no. & grades) | Hgt. (total hgt. ft.) | Cl. (tree class) | Descrip. (tree description) | Would cut (would be cut by) |
|---|---|---|---|---|---|---|---|

The second page of the note book will be headed in the same way except that the word "leave" will replace the word "cut". Thereafter, alternate pages will be similarly headed for cut and leave.

These headings are nearly all self-explanatory, or are explained by the words in parentheses beneath. The tree classes will be recorded by the usual numbers 1 to 7. Under the heading "Description" will be entered the usual tree descriptions in code as described in "Methods of Cutting" instructions. In the case of leaning trees, the approximate direction and degree of inclination should be entered after the symbol 1ℓ (e.g., 1ℓ15S). Under the heading "Would Cut" use the abbreviations F.S. for Forest Service, "M" for Mason & Stevens, "P" for Pickering Lumber Company, and "H" for heavy cutting.

The first six headings will be confined to one column each. "Descriptions" will require four columns, and "Would Cut" will require three columns.

The personnel, equipment, and duties of the marking and numbering crew will be as follows:

1 marker, with Forest Service marking axe.
1 hypsometer man, with Klaussner hypsometer, staff, and range finder.
1 man to number and measure diameters of cut trees, equipped with a 20 ft. diameter tape, metal tags, 8d. nails and hammer.
1 man to number and measure diameters of leave trees, with hand axe, marking crayon and 20 ft. diameter tape.
1 note keeper, with standard Forest Service field notebook.

Record of Trees Below 12 Inches.

When marking and numbering is completed a tally of trees below 12 inches in diameter will be made for at least three plots by species, inch classes and tree classes.

Log-grading in Standing Trees.

All trees 12" and over will be log-graded by the District Logging Engineer, J. R. Berry, and his assistant, B.O. Hughes. This work will be done following marking and numbering. The standard method of tallying will be used, i.e., for each tree, showing the number of logs in each grade, the first digit representing No. 1 logs, the second digit No. 2 logs, and so on.

Examples - SP (a 10-log sugar pine with 2 No. 1 logs,
2233 (2 No.2, 3 No.3 and 3 No.4

WP (a 9-log white fir with 1 No.2 log
018 (and 8 No. 3 logs.

YP (a 2-log western yellow pine with
002 (both logs in Grade 3.

The log-grading rules are given below:

Western yellow and sugar pine -

Grade #1 logs - Select logs: May be any length over 10' and any diameter over 8" inside bark at the small end. Two knots are permissible near the end of a log over 36" d.i.b., if the remainder is surface clear. Smaller logs must be surface clear for the entire length. Small, dead knots, or indication that "pin knots" are near the surface, are as effective in reducing the grade as are live limbs.

Grade #2 logs - Shop logs: May be any length over 10' and any diameter over 8" inside bark at the small end. Knots, of any size, and other blemishes, are permissible if they are so distributed as to produce lumber from which factory cuttings may be obtained between the defects. At least 60% of the log surface should have the defects spaced 8' apart, vertically, and the defects on the remainder of the surface must be at least 3' apart. Logs having 75% clear surface may have any type of defect on the remaining 25%.

Grade #3 logs - High common logs: These logs are usually from small or young trees. They may be any length over 10' and any diameter over 8" inside bark at the small end. Any number, up to twice the diameter of the logs, of green knots up to 2" diameter, and "tight black" knots, up to 3/4" diameter, are permissible, if they are distributed fairly uniformly.

Grade #4 logs - Low common logs: Merchantable logs which do not qualify in any of the higher grades. They come mainly from the tops of the older trees and produce lower common and shop lumber.

Fir and Cedar -

Grade #1 logs - Select logs; See grade #1 pine. Will permit 4 knots in 36" logs and 2 knots in smaller.

Grade #2 logs - High common logs: See grade #3 pine.

Grade #3 logs - Low common logs: See grades #2 and #4, pine.

Final Survey and Marking Boundaries

When the plot boundaries have been definitely located, a survey will be made with transit and tape. The boundaries will be marked by blazing and by stakes at two-chain intervals along the sides and at the corners. Corner stakes will be witnessed in the usual way.

A compass survey will be made to show general location of plots and land survey ties.

Mapping of Plots

Preparatory to mapping, the areas will be divided into squares, two chains each way, by setting temporary stakes with transit and tape. The previously established boundary stakes will serve as controls. Elevations will be taken on the boundary and interior stakes as a basis for topographic maps.

After staking is completed, the detail will be mapped with a plane table, alidade, and tape or range-finder, using the stakes for location and orientation. The usual procedure for methods of cutting plots will be followed for the 10-acre permanent plots and isolation strips. On the remainder of the larger plots only the trees 12 inches and over will be located on the maps.

The detailed maps will be on a scale of one inch to thirty feet. General location maps showing land survey ties may be on a convenient larger scale.

Reproduction transects will be located and staked with transit and tape and mapped in the usual way on each of the 10-acre permanent plots.

Photographs will be taken from marked locations for future repetition.

Felling, Limbing and Bucking

Felling and log-making on the plots must begin about June 1 in order to release the time study crew for the yarding operations, including a short training period, before July 5. Felling, limbing and bucking time studies will be made on all three plots.

The lower portions of large trees are bucked in 16-foot lengths. Otherwise, 32-foot lengths are standard when not too heavy for the tractor and when breakage, crotches, etc., do not interfere.

The company will assign fallers, limbers and buckers for work on the study area in accordance with a schedule to be arranged later by company and Experiment Station representatives. There is yet a little uncertainty regarding the exact dates of arrival of one or two members of the felling study crew, but as soon as the full crew of eight can be assembled, they can take care of two sets of fallers, two limbers and four buckers. June 1 is tentatively fixed as the starting date for felling and limbing, and June 3 for bucking.

Felling and bucking should be completed on Plots 1 and 2 before Plots 3 and 4 are started, then in case all of the latter cannot be finished before July 4, the costs of cutting the balance can be calculated later from the results obtained on the rest of the area.

M. E. Krueger of the University of California, Division of Forestry will prepare detailed instructions for the use of the time study crew. In general, the time studies will be made as follows:

1. Felling. One man will be assigned to each set of fallers. He will segregate the various sub-divisions of the job in accordance with the headings shown on Form 10. After each tree is cut, he will nail the metal tree-number tag in the center of the stump for later reference, and write the number on the base of the butt log.

2. Limbing. One man will be assigned to time each limber, dividing the operation into the sub-divisions shown on Form 11. In addition to showing the total time for each tree, he will note in the space above each tree number, the total time chargeable to each 16 ft. log requiring limbing with the exception of those items such as "Walking to tree" and "Waiting for others", which must be prorated over all logs.

3. Bucking. One man will be assigned to time each bucker, recording the data as shown on Form 12. It is possible that one study timer will be able to follow two buckers occasionally when the latter can arrange to work on adjacent trees. The bucking study timers will write the numbers on each log as described under "Numbering of Logs in the Woods", page 41.

TIME STUDIES
FELLING

Form 10
DIV. OF FOR.
UNIV. OF CAL.

---

Tree number ..... Species ..... Date ....., 19.....

D.B.H. ..... in. Stump diameter ..... in.

Stump defect (% of area) ..... %. Depth of cut ..... in.

of undercut ..... in. Total height ..... ft.

Merchantable length ..... ft. to ..... in. top

Used length ..... ft. to ..... in. top

Total scale, gross ..... net .....

Defect, ft. b.m. ..... Breakage, ft. b.m. .....

Distance from last tree .....

TIME: Walking ..... Swamping .....

Planning ..... Undercutting, Saw .....

Axe ..... Barking .....

Preparing to saw ..... Sawing .....

Wedging ..... Resting .....

Waiting for others ..... Tools .....

Delays .....

.....

Remarks: .....

.....

.....

.....

.....

2m-4,'29

TIME STUDIES
LIMBING

Form 11
DIV. OF FOR.
UNIV. OF CAL.

Number of tree ..... Species ..... Date ....., 19....

D.B.H. ..... Total length ..... ft. Merchantable length ..... ft. to ..... in. top. Used length ..... ft. to ..... in top. Length limber ..... ft.

Character of limbs: numerous, moderate, scanty; approximate average diameter ..... in. Distance walked .....

TIME: Walking to tree ..... Walking along tree .....

Preparing ..... Chopping .....

Sawing ..... Resting .....

Waiting for others ..... Delays .....

Remarks: .....

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**TIME STUDIES**
**LIMBING**

Form 11
DIV. OF FOR.
UNIV. OF CAL.

Number of tree ..... Species ..... Date ....., 19....

D.B.H. ..... Total length ..... ft. Merchantable length ..... ft. to ..... in. top. Used length ..... ft. to ..... in top. Length limber ..... ft.

Character of limbs: numerous, moderate, scanty; approximate average diameter ..... in. Distance walked .....

TIME: Walking to tree ..... Walking along tree .....

Preparing ..... Chopping .....

Sawing ..... Resting .....

Waiting for others ..... Delays .....

Remarks: .....

1m-4,'29

TIME STUDIES
BUCKING

Form 12
DIV. OF FOR.
UNIV. OF CAL.

Number of tree ..... of cut ..... Date ....., 19.....

Species ..... Diameter cut .....

Per cent of area cut defective ..... % Distance walked .....

TIME: Walking ..... Swamping .....

Sawing ..... Wedging .....

Chopping ..... Resting .....

Waiting for others ..... Delays .....

Tool fitting and sharpening ..... Scale: gross ..... net .....

Remarks: .....

TIME STUDIES
BUCKING

Form 12
DIV. OF FOR.
UNIV. OF CAL.

Number of tree ..... of cut ..... Date ....., 19.....

Species ..... Diameter cut .....

Per cent of area cut defective ..... % Distance walked .....

TIME: Walking ..... Swamping .....

Sawing ..... Wedging .....

Chopping ..... Resting .....

Waiting for others ..... Delays .....

Tool fitting and sharpening ..... Scale: gross ..... net .....

Remarks: .....

4m-4,'29

Felled Tree Analysis Records

A new form has been prepared for keeping a graphic record of all trees cut after they have been limbed and bucked ready for yarding.

On these forms the following will be shown:

1. A diagram of the bole of each tree from stump to tip drawn in the field on a scale of 15 feet to the inch for length and 50 inches to the inch for diameter.

2. The height and diameter of each stump and the stump waste, if any.

3. The calipered diameter O.B. at the end of each log, the average thickness of the bark and the DIB. These figures are to be entered opposite each cross-sectional cut as shown in the diagram, under the heading "D.I.B. inches", as follows:

)meaning an average D.O.B. of
37 )37 inches, bark thickness of
4 )2 inches (x2) and D.I.B., or
33 )scaling diameter of 33 inches.

4. The log numbers, to be written in on the diagram directly above the lines showing the cuts made by the woods buckers.

5. The length of each log both by plotting on the diagram scale and by recording the length of each section under the column heading "Length".

6. Breakage, cull material bucked out to be left in the woods, material lost in cutting out crotches, etc.

7. Length of crown and clear length of bole.

8. Material not utilized in tops.

WOODS STUDIES
For Exp. Sta.
Form W 4

# FELLED TREE ANALYSIS

N.F. _____
Project _____
Date _____

TREE NO. _____
Species _____
Tree Class _____
D.B.H. _____
Tot. Hgt. _____

STUMP
Max. Height ___ Inches
Min. " ___ "
Avg. " ___ "
Waste " ___ "

INSTRUCTIONS: In diagram show actual sawcuts by solid lines (——). Show probable cuts to be made on mill deck and merch. limits in case of untrimmed breaks by dotted lines (- - -). Sketch in actual breaks, forked tops, etc.

| Tree Diagram Log Numbers | D.I.B. Inches | Length Feet & Tenths | Remarks (A-Avoidable Breakage) |
|---|---|---|---|
| | | | |

Length in Feet

| Tree Diag. & Log. Numbers | DIB Ins. | Lgth. Feet & Tenths | Remarks |
|---|---|---|---|
| | | | |

TREE SUMMARY
Dec. C.
Gross Volume to 8" top ——
Cull - - - - - - - - ——
Net Volume —— 
NOT UTILIZED
Breakage - - - -
Bucking Waste - - - - - ——
Top to 8" - - - -
Stump - - - - -
Net Vol. Utilized ——

Note: Measure D.I.B. of unmerch. top at approx. middle point between tip and saw-cut.

These records will be invaluable as an aid in summarizing all log data in the form of the original trees and especially in correlating standing tree with mill deck log grades.

Two men will work together, one taking the measurements and the other recording. The work will be done as follows:

1. Measure the stump height at lowest and highest points.

2. Measure the average stump DIB and record opposite the butt cut under the "DIB" column. See that the tree tag number is correctly copied on the butt cut.

3. With a steel tape, measure the length of each log as bucked by the company buckers. Show the saw cuts as solid lines in the diagram. Opposite these lines, under "Length", record the length of each log in feet to the nearest tenth foot.

4. From the bucking study field forms previously prepared during log making operations, the diameter of each cut should be copied on the "Felled Tree Analysis" form and each log should be shown diagrammatically by plotting according to the length and diameter scales shown at the sides and ends of the spaces provided for this purpose.

5. Show the first green limb at base of crown by entering "X" on the bole diagram opposite the proper sub-division of the height scale.

6. Show length and middle diameter of unutilized tops to an approximate DIB of 4 inches, also the remaining length of the tips so the total height of each tree will be shown on the scale.

7. Further details will be explained in the field and an outline of condensed instructions will be prepared for pasting on the cover of the tatum holder.

Numbering of Logs in the Woods

Logs will be numbered consecutively as bucked in the woods, regardless of length, beginning with the butt log as number 1 and continuing up the tree. Each log will be numbered by the bucking study timer except the butt cut number, which will be put on by the felling study timer when he places the tree tag in the center of the stump.

On the logs which fall or roll apart after bucking, the number can be written directly on the cut surface. When the end cuts are not exposed, the bucking study timer will blaze into the sapwood on opposite sides of the log just below the cut and write the numbers so they can be copied on the ends by the yarding study crew men when the logs are pulled apart by the tractor.

All numbers will be checked later by the felled tree analysis crews. The loading timer's assistant will carefully inspect the bucking timer's numbers and re-mark those which are not legible.

The system of log designation on the mill deck, where most of the long logs will be bucked in two with a steam dragsaw, will consist of copying down the woods numbers and adding "a" and "b" for the lower and upper sections, respectively, e.g., woods section number 4, length 33 feet, from tree 450 would be marked on both ends "450". After bucking on the mill deck into two sixteens or perhaps a

fourteen and an eighteen, the lower portion (towards the butt) would be recorded by the scaler and log grader as 450-4a and the upper portion as 450-4b. The exact position in the tree of each section as finally cut for the headsaw can be instantly determined by referring to the felled tree analysis forms.

Experience in District 1 showed that log numbers made with soft crayon carried through successfully to the mill deck. It is planned to use the same system in this study unless preliminary tests prove that it is not satisfactory under the conditions encountered on the Pickering operation. Die hammers, numbered from 0 to 9, will be used if no other method is feasible.

Yarding, Loading and Final Marking for Mill Identification.

Yarding is now scheduled to begin on July 8 with a skidding unit of five tractors and loading crane. There is a chance that the beginning of this operation may have to be delayed by a few days if weather conditions, which have already made it impossible to accomplish the preliminary work as originally planned, continue further to upset the chronological schedule already sent to the cooperating agencies.

The study crew which times the felling, limbing and bucking operations will be assigned in toto to the yarding and loading studies. One man will be required to follow each tractor, one to time the loader, and one to assist the latter, act as final number inspector, re-marking those which may have become defaced during skidding, and place crayon marks on the ends of each study log parallel to, completely around and about two inches in from the peripheries of the saw cuts. These latter identification marks

are to enable the pondmen more readily to distinguish the study logs after unloading into the pond where they will become mixed with logs from other areas. The circular marks will also be helpful to the scalers on the mill deck who will not have to waste any time looking for numbers on logs which show no circular markings.

Logs will be yarded to the railroad landing by direct skidding, hooked to the tractors with steel rope chokers. Digging choker holes under the logs, setting chokers, hooking, skidding, unhooking and returning from the landing are the main sub-divisions of the yarding operation which must be segregated in the time studies.

The logs are left alongside the loading crane which lifts them from the ground, one at a time, to flat cars spotted on a loading spur. The loads are bound by means of heavy steel chains attached to the bunks. From 7 M to 10 M feet are carried to the load, depending on the sizes of the logs.

In the loading operation, selection and "hooking" of each log, swinging and dropping on the car, placing the log (when special maneuvering is necessary), binding the load, and spotting and preparing empty cars, are the main elements of the process to be segregated by the time study man.

Mr. Krueger, who will also be in charge of the yarding-loading study crew, will prepare detailed instructions for the tractor and loader timers.

One study man will be assigned to each tractor, recording the sub-divisions of time required to yard each turn, and other data, as shown on Form 13.

The timer stationed at the loader will show the time required to load each log and also the general items chargeable to the entire car load such as switching and binding. Form 14 shows the sub-divisions to be segregated.

Transportation from Woods to Mill

Loaded cars will be switched out twice a day and sent to the mill at Standard on the two regular trains which have been mentioned previously. Barring wrecks and other unavoidable delays, each day's run of study logs should arrive in Standard not later than the following day.

The costs of transportation for logs and trees of different sizes, species, and percentages of merchantability will be calculated by correlating the railroad operating expenses, reduced to an average unit volume cost per mile basis, with the individual car load records kept by the loading study timer.

Handling of Study Logs in Mill Pond

After the unloading of each train at the pond the logs from the study plots will become more or less scattered among those from other areas. By volume, the ratio will be about 1 to 3, i.e., one car of study logs to two cars of non-study logs. It is the usual practice of the company to deck at the

**TIME STUDIES**
**YARDING**

Form 13
Div. of For.
Univ. of Cal.

---

Turn number ..... Species ..... Date ....., 19.....

Position of log in tree ..... Slope % .....

Trail number (refer to map) ..... Distance .....

| Log Length | Top Diameter | Gross Scale | Net Scale |
|---|---|---|---|
| | | | |

Total time ..... to .....

TIME

Out ..... Delay .....

..... Delay .....

Turn ..... Delay .....

Hook ..... Delay .....

..... Delay .....

In ..... Delay .....

..... Delay .....

..... Delay .....

Unhook ..... Delay .....

Turn ..... Delay .....

Total effective ..... Total delay .....

Remarks: .....

.....

.....

.....

.....

.....

.....

12m-3,'27

**TIME STUDIES**
**LOADING**

Form 14
DIV. OF FOR.
UNIV. OF CAL.

Log. No. ..... Car No. ..... Date ....., 19.....

| Species | Length | Diameter | Gross Scale | Net Scale |
|---|---|---|---|---|
| | | | | |

TIME

Out ..... Delay .....
Hook ..... Delay .....
In ..... Delay .....
Placement ..... Delay .....
Unhook ..... Delay .....
Spotting car.....
Preparing car.....
Binding .....
Total ..... Delay .....
Remarks: .....

**TIME STUDIES**
**LOADING**

Form 14
DIV. OF FOR.
UNIV. OF CAL.

Log. No. ..... Car No. ..... Date ....., 19.....

| Species | Length | Diameter | Gross Scale | Net Scale |
|---|---|---|---|---|
| | | | | |

TIME

Out ..... Delay .....
Hook ..... Delay .....
In ..... Delay .....
Placement ..... Delay .....
Unhook ..... Delay .....
Spotting car.....
Preparing car.....
Binding .....
Total ..... Delay .....
Remarks: .....

7m-4,'29

rear end of the pond most of the fir and cedar and part of the low grade pine for winter sawing after the camps have been shut down. The pond is practically one hundred per cent filled all through the logging season.

It is , of course, essential to saw all of the study logs sent to the mill, regardless of species and grade, within the three weeks that the mill study crew is on duty. To this end, the pondmen will be instructed to direct all study logs promptly toward the slip as rapidly as circumstances will permit. The ideal standard of efficiency will be to have each day's run of timber from the plots sawed and tallied within the 24 hour period following its arrival at the pond. The men employed in the decking crew will watch carefully for marked logs which may inadvertently be back-washed to their end of the pond, and if any appear they should be pulled to one side or returned to the channel of movement toward the mill slip.

One pondman on each shift should be made responsible for directing the study logs along the boom leading to the mill and rounding up the strays before they drift too far away from the unloading dock.

Special effort should be made to recover all sinkers. Whenever a log is lost from a tree, actual correlation of the entire tree with the green chain tally is also lost. White fir sinkers are even more important in this study than pine sinkers.

Movement of Logs Into Mill

The pondmen at the foot of the log slip are required to maintain an even distribution of sizes suitable for each headsaw. The rig on the left (as the logs enter the mill) is equipped to handle the large logs while the one on the right takes the smaller logs. The company scaler, who also handles the levers and steam bucking saw, diverts incoming logs to one side or the other so that each will have a constant reserve supply ahead of sawing. Study logs will be handled in exactly the same manner as to pond selection between small and large diameters and diversion to each headsaw. The only exceptions to the standard methods of handling which will be necessary while the study is in progress are as follows:

1. Giving preferred attention to the study logs with the objective in view of keeping their movement through the mill practically even with their receipt from the woods.

2. Sawing all fir and cedar from the study plots along with the pines, i.e., no decking nor withholding of certain classes of material.

Scaling - Mill Deck

One scaler will be assigned to each side. The one scaling for the left, or large log rig, will use even numbers exclusively, and the one scaling for the right, or small log rig, will use odd numbers exclusively. The numbering shall correspond with the order of sawing in one series from beginning to end of the mill study.

Standard scaling methods will be employed except that all details must be recorded on Form M-1, "LOG SCALE", and finer distinctions must be made between cull from different causes.

The scalers will proceed as follows:

1. Record the woods number, showing the top section as "a" and the lower as "b" for long logs bucked in the slip. (The sheets will be numbered in advance for mill numbers by means of a numbering machine.) If not a study plot log, record the camp designation.

2. Record the species by the usual abbreviations. Distinguish between Jeffrey pine (JP) and western yellow pine (YP).

3. Measure and record length to nearest inch.

4. Record length used for determining scale, as "17 ft." for a log 16'9" long.

5. Record average diameter of small or scaling end to nearest inch as actually scaled (gross). Add + or - sign to show whether dropped or raised; no sign if actual diameter is the same as scaling diameter. Examples:-

   Small end 30 inches: average diameter is actually 30 inches.

   Small end 30+ inches: scaled as 30 inches but actual diameter was over 30 inches, though not more than 30.5 inches.

   Small end 30- inches: scaled as 30 inches but actual diameter was between 29.6 inches and 29.9 inches.

Mill Studies
D-5
Form M 1

Project_____

Date_____

# L O G  S C A L E

Woods No. _____ Species _____

Length, feet & Inches____ Scaled as____ft.

Average diameter { Small end _____inches.
Large end _____inches.

Green _____ Dead _____

GROSS SCALE (Dec.C)-_____

REDUCTION FOR DEFECTS
(Check cause)

NORMAL:
Rot; Shake; Int.check; _____
crook _____

SURFACE:
Dec'd.Sap; Check _____
Cat face _____
Lightning scar _____

OPERATING:
Break; Slab;
Split ends _____

MISC. _____ (cause), _____

TOTAL DEFECT - - - _____

NET SCALE (F.S.) - _____

(Standard log diagram with circles on each end, will appear in this space on the printed forms.)

Remarks:

Cubic foot content
Gross _____
Net _____

_____Log No.

(Size of form - 4-5/8" x 9-1/4")

For 18 foot and longer logs not bucked in the slip, show the two lengths scaled by entering the smaller diameter portion above the larger, as follows:

"Length, feet and inches, 22'10", scaled as $\frac{10}{12}$ ft."

and after "average diameter" enter also the diameter used for the lower portion, as follows:

Average diameter { Small end $\frac{35+}{37}$ inches
Large end 41 inches

Plus and minus signs need not be shown for either the middle or large diameters.

6. Check whether log is from green or dead tree.

7. Enter cull, if any, checking specific cause or causes. Oftentimes it is difficult to separate the losses chargeable to a single cause when two or more defects are combined. In such cases check-mark all of the causes, entering the footage to be deducted after the proper subheading. If the combined causes come under two headings and cannot be separated, show total deduction after "TOTAL DEFECT" and check each cause.

Example No. 1: Rot and shake combined, loss 10 board feet, not separable: - check the words "Rot" and "Shake" and enter 10 in space provided, after "NORMAL".

Example No. 2: Rot and cat face combined, loss 40 board feet, not separable: - check "Rot", check "Cat face", and enter 40 after "TOTAL DEFECT".

8. When cat face, decayed sap, check or rot are clearly traceable to fire injury, write "F" above, below, or at one side of the particular cause checkmarked.

9. Sketch splits, shake, rot, cat face, rotton knots, etc., on the log diagram.

10. On logs with unmerchantable sapwood, be sure to measure the full diameter, including sap, and record this figure after "Average diameter"; then in ( ) write the scaling diameter of the merchantable core.

11. When logs are coming in too rapidly to allow sufficient time for all entries, the scale figures should be omitted rather than the diameters and exact lengths. If the latter are accurately recorded, the scale can be determined later. If there is no time to calculate cull in board feet from the external measurements, jot down the data for later calculation after checking the cause of defect. Enter the actual footage losses from cull directly on the form, however, when time permits.

12. Do not write the mill number on the end of the log toward the headsaw, but always write the last digit on the end toward the slip. This will enable easy checking of the log being placed on the carriage at any time. When one log is accidentally kicked ahead of another, the change will be made only on the scale and grading forms. From the carriage on through the mill the numbers must be consecutive without exception.

The scale sheet corrections for logs out of order is a simple matter if each scaler will form the habit of watching the carriage and the line-up of numbered logs on the skids leading from the slip. The last digit of each mill number should be made large so there will be no difficulty in reading it from a distance. A line should be drawn under 6 and 9, even though they are supposed to go always to opposite sides.

If the logs are lined up from the carriage 7-9-1-3-5, representing, say, 97-99-101-103 and 105, and #1 is kicked ahead of the first two, the scaler should turn at once to sheet No. 101, and change the mill number to 97, then change 97 to 99, and 99 to 101. No's. 3 and 5 will not be affected, of course, unless further dislocation takes place. If time permits, the changed numbers should also be written on the ends of the logs which have been advanced to the next higher number, although this is not essential. There will probably be little trouble of this nature on the large log side (even numbers), but there may be considerable "jumping" on the small log skids.

Whenever the scaler has a chance, he should walk down to the edge of the carriage runway where he can see the board marker and signal the last digit of the number of the log then on the carriage by holding up one of the large, numbered cards, a set of which will be provided for each side.

Log Grading - Mill Deck

The log grader will work with the scalers, using Form M-2, "LOG DESCRIPTION".

Procedure:

1. Enter woods number (or camp mark) and species designation. (See scaling instructions.)

2. Determine the grade of the log as bucked for the headsaw, entering the grade number after "Mill _____".

3. Estimate the position of the log in the tree. Butt logs can always be identified by the under cut, as can also second logs bucked from long butt cuts by the deck saw. Top logs can be readily identified in most cases. For all other logs, an attempt should be made to estimate the position from a brief examination of various growth characteristics correlated

Mill Studies D-5
Form M 2

Project _____

Date _____

# LOG DESCRIPTION

Woods No. _____ Species _____

## Log Grade

Woods _____
Mill _____

Position in tree: Butt___; Middle___; Top___
(No.)

Tree class _____

Avg. thickness of sap. small end_____inches

Surface appearance (Smooth _____
(Medium _____
(Rough _____

Spiral grain: Slight___; Mod.___; Severe____

Number of knots: 1"__2"__3"__4'__5"__6" ____

(Note: On the printed forms, two log diagrams, divided by vertical lines into 4-foot sections, - one diagram above . . . . .

Length 4' 8' 12' 16' 20'

. . . . . and one below the length scale, to represent both sides of the log - will appear in these spaces.)

(Write in figures to indicate knot diameters)
(Dots to indicate knots less than 1" diam.)
When knots are too numerous to record individually, write in diagram:

SK for numerous small knots
LK " " large "

Remarks:

_____Log No.

(Size of form - 4-5/8" by 9-1/4")

with taper and diameter. Whenever a study log is concerned, this estimate of position should be made prior to the reading of the woods number and should not be changed subsequently if found to be wrong. What is wanted is a check on the accuracy of estimating position in the tree for possible future application where mill and woods studies are not tied together. Put down the estimated position by number (16 foot log basis) for all study logs. For the balance use the following symbols after "Middle____":

2 - when bucked from a butt log.

T/2 - when fairly evident that the log is second from the top, taking into consideration taper and knots with indications that another log at least 10 feet long and 8" to 10" DIB, small end, was above it in the tree.

T - for other logs in top half of tree.

L - for other logs in lower half of tree.

4. Estimate the thrift class of the tree (1 to 7) and enter on proper line.

5. Record average thickness of sapwood.

6. Check the surface appearance. For extremely smooth appearing logs, place two check marks after "Smooth". For extremely rough logs, place two check marks after "Rough".

7. When spiral grain is evident, record as slight, moderate or severe by check mark.

8. Checkmark the log length in the space between the two diagrams. For a 14 foot log, place the check mark half way between 12' and 16' and so on for other lengths not printed on the form. For a 22' log, draw side lines to edge of sheet. For 24', cross out 20' and write in 24', and each subdivision can then be considered as a five instead of a four foot section.

9. Show position and size of knots on both sides of the log by recording the figures showing diameter in inches, these to be written on the diagrams in the same relative positions as the knots occur in the log. When knots are too numerous for diagramming, count the number in each diameter class, if possible, and record in the spaces provided. When impracticable to make a count use the abbreviations as shown below the diagrams.

10. Under "Remarks" note such items as light, medium, or heavy log stain, bole mistletoe, evidences of insect attack and other abnormalities not specifically provided for on either the log scaling or log description forms.

Timing Logs at Headsaw

Marking Boards for Green Chain Identification

Two study crew men on each shift will be stationed alongside the live rolls leading from headsaws to edgers, one man for each side. Both duties specified in the above heading will be performed by the same man, hence they are combined in one set of instructions.

Each board marker will be provided with a decimal stopwatch, pencils, lumber crayons, measuring rule and a supply of Forms M - 3. The series of log numbers will be stamped on the forms in advance of the study.

M-3

## BOARD MARKER'S RECORD AND SAWING TIME

| Log No. | Woods No. | * Sp. | Sizes in slabs 1 | 2 | 3 | 4 | Miscellaneous & timbers | Sawing time- Minutes Total | Delays & Cause |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |

* Record T above species designation for taper sawed logs

The duties of each marker will be as follows:

1. Make a notation of the first log sawed in each half shift by writing above the log (mill) number "1" for the morning shift, "2" for the afternoon shift, "3" for the first half of the night shift, and "4" for the last half of the night shift.

2. Time each log from the instant it is rolled on the carriage until the carriage returns again for the next log; in other words, the stopwatch would be read and set back to zero every time the empty carriage is lined up to receive a log. Enter the total time under "Total" on Form M-3. When delays occur, jot down the readings at the beginning and end of the lost time, but do not re-set the watch. Note briefly the cause, as "Out of logs", "Cut off limb", "Shattered account rot", "Change saw", etc.

3. Write down the woods number if it can be seen plainly, otherwise simply place a small check mark under "Woods No." for study logs showing the circular marking.

4. Note species designation.

5. Record "T" in upper right corner of each square under "Sp." for logs which are taper sawed.

6. Mark every board with the last digit of the number of the log from which it is sawed. This should correspond, of course, to the last digit of the mill number shown on the form (M-3). This numbering will be a constant repetition of the Series 2-4-6-8-0 on the large log side (green crayon) and 1-3-5-7-9- on the small log side (red crayon). Be sure the marks are placed where they will not be edged or trimmed off.

7. Record the dimensions of clear (or small knotted) material lost in slabs down to a minimum of 1" x 3" x 4'. When 1" (4/4) is the thickness of the piece which could be recovered, write down only the figures for width and length, e.g., 3-8 will mean 4/4 x 3" wide x 8' long. For thicker material, add number of quarter inches, as 5 x 4 - 10, denoting 5/4 x 4" x 10' long. Note also the dimensions of any sound material not smaller than 1" x 3" x 4', aside from that contained in slabs, which is sent to the slasher chains. Most of the small dimension stock to be recorded on this form may not be merchantable from the economic standpoint, i.e., the cost of recovery is probably greater than its selling value, but the record will show what would be available for utilization under more favorable market conditions.

8. Watch for card signals from the scaler for a check on the log being cut. Make no changes whatever if one log is kicked ahead of another. Continue always in regular sequence regardless of any mix-up which may appear to occur in the line-up of logs on the skids.

9. Record the dimensions of all large timbers which do not go to the sorting table. Write the full mill number on each timber, if possible.

The board marking job is the vital connecting link between log deck scale and sorting table tally. Every board must be marked plainly for easy and instant identification by the graders on the green chain. The lumber from both sides will be mixed as soon as it reaches the trimmer table and the duties of the graders and tallymen allow no time for close scrutiny of marks, nor do the exacting requirements of the study permit any guess work.

Edging and Trimming Data

Edging and trimming data will be recorded on Forms M-4 and M-5 by one man who is to alternate between both edgers and between lumber from both sides at the gang trimmer. The purpose is to determine the amount by sizes of small dimension material now sacrificed in edging and trimming boards to the standard grade-dimension classes called for by present market requirements.

M-4 E D G I N G D A T A

| Log No. | Sp. | Woods No. | Diam. | S | L | Lgth. | Grade | Scale |
|---|---|---|---|---|---|---|---|---|
| Dimensions | Bd. | Merch | Bd. | Reason | | | | |
| Th | W | W | L | Ft. | W | L | Ft. | S | U | G | Q | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | (repeat) |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |

M-5

# T R I M M I N G D A T A

LOG NO. Sp. Woods No. Lgth. ' Diam. " Scale Dec.C

| REASON: | ENDS - Width" x lgth.' sound cuttings: 4/4 | 5/4 | 6/4 | 8/4 | MIDDLE 4/4 | 5/4 | 6/4 | 8/4 |
|---|---|---|---|---|---|---|---|---|
| 1. | | | | | | | | |
| D | | | | | | | | |
| E | | | | | | | | |
| F | | | | | | | | |
| 2. WANE | | | | | | | | |
| 3. GRADE | | | | | | | | |
| 4. ? | | | | | | | | |

Gross Trim bf: Sound bf. 1 2 3 4 ,Total :Unmerch. bf.

The procedure will be as follows:

1. Start with the first board from a given log on either edger or at the trimmer, entering full mill number and species at top and thereafter recording the data separately for consecutive logs until ready to change to the opposite side. The log number at the beginning of each change from one edger to the other, or from one side to the other at the trimmer, should be obtained from the board marker.

2. On Form M-4 estimate the dimensions of sound material edged off and discarded to the slasher chains. An explanation of the form headings will show the entries required:

   Under "Dimension" - "Th" is thickness of board in quarter inches (4 for 4/4, 6 for 6/4, etc.); "w" is the width in inches of the smaller end of the edging and "W" is the width of the larger end. If the center of the edging is narrower than the smaller end, enter a dash between "w" and "W", thus "3-6"; "L" is the length of the edging in feet. The "Bd.ft." columns will be filled in later. "W" and "L" in the next two columns are for the width and length of the largest, straight edged, clear (or pin knotted) cutting obtainable, down to a minimum of 4' long for a minimum width of 1", or 2' long for a minimum width of 2". Under "Reason", "S" means an edging to size, i.e., to attain a specific standard width;

"U" is an edging to remove an unmerchantable portion such as rot; "G" is an edging removed solely to raise the grade of a board; a check mark under "Q" indicates that no reason for the edging is apparent to the observer; if the edging is for wane, no check mark will appear under "Reason".

3. On Form M-5, there are two main divisions for segregating trims from the ends of boards - "ENDS" - and those made to remove interior defects - "MIDDLE". The four principal thicknesses appear as column headings. Across the form, the trims are classified as to "REASON". No."1 DEF." means a trim to remove defective material, such as rot, rotten knots, breakage, bad splits, shake, etc. The kind of defect should be written in. Record only the width and length of sound, clear or small knotted material not less than 2" wide x 2' long, which could be salvaged. This rule also applies to the balance of the sub-divisions: "2. WANE" is a trim to remove wane only. "3.GRADE" is a trim entirely sound (solid, intergrown knots), but which would degrade the board if left on to such an extent that its full size value would be less than the reduced size value in the higher grade. "4.?" is for trims not covered by the headings above.

Gross trims can be quite accurately determined by computation after the mill study is completed, since the length of every board will be recorded on the greenchain tally sheet and the exact length of each log will appear on the scale forms. There will be a possibility of error in adjusting for middle trims, but this can be reduced to insignificant proportions by apecial marks of identification on the green chain tally sheets to show separate pieces cut from the same original board.

Grading and Recording on Green Chain

One lumber grader and one tallyman will be provided to grade and record the lumber from each headsaw. This will require four graders and four tallymen to take care of both shifts. Two of the graders will be inspectors loaned by the California White and Sugar Pine Manufacturers Association (to be paid from the project funds), and two will be experienced shipping graders regularly employed by the cooperating company. The latter will be selected by the chief grader of the Association.

One association grader and one company grader will be assigned to the day shift, and one of each to the night shift.

Each grader will call off and grade mark (shipping grade "as is", assuming no added defects in the lumber after drying) every board coming from the side to which he is assigned. By this method, one grader will need to watch for only one color - red for the grader taking the odd-numbered (small log) side, and green for the grader taking the even-numbered (large log) side.

As the first board of each succeeding log appears on the chain, he will call "New number" or "Next log", followed by the number written by the board marker. Thereafter he need not repeat the same number unless there has been a mixup owing to delay in front of the trimmer which throws a few boards out of order.

The grade marks will be those used regularly by the company for designating shipping grades. The grade marking of every board is essential for the depreciation study.

The tallyman will record each piece by thickness (5 for 5/4, 6 for 6/4, 8 for 8/4, etc.) width (number of inches) and length (number of feet) under the grade headings on Form M-6 corresponding to the grades designated by the lumber grader. Notation of thickness may be omitted for 4/4 stock. Tally marks may be used in the "Ft" column when several boards of the same dimensions and grade are encountered.

M-6

GREEN LUMBER TALLY
By grades

Log No. Sp. Woods No.

| SELECT | | | | | | | | | SHOP OR DIMENSION | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 & 2 Cl. | | | C | | | D | | | 3 Clear | | | No. 1 | | | No. 2 | | | No. 3 | | |
| T | W | L | Ft | T | W | L | Ft | T | W | L | Ft | T | W | L | Ft | T | W | L | Ft | T | W | L | Ft. |
| | | | | | | | | | | | | | | | | | | | | | | | |

(Note: 22 lines and space for totals provided on printed forms between headings shown here)

| COMMON | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. 1 | | | | No. 2 | | | | No. 3 | | | | No. 4 | | | | No. 5 | | | | (This column for Timbers, Ties, Moulding and Misc.) | |
| T | W | L | Ft | T | W | L | Ft | T | W | L | Ft | T | W | L | Ft | T | W | L | Ft | | |
| | | | | | | | | | | | | | | | | | | | | | |

(Note: 22 lines and space for totals provided from above headings to bottom of page)

A separate sheet will be used for each log. Log numbers (mill) will be stamped on the forms in advance. Species letters should be recorded by the tallyman. The woods number will be copies later from the scale sheet.

More detailed instructions for green-grading and tallying will be prepared later for review by the graders and tallymen.

General Supervision of Mill Study

The man in charge of each shift (study crew) will make the rounds from pond to sorting table several times each day (or night) to see that all details of the work as presented in this plan are being carried out in an efficient manner. He should make frequent checks between log deck, board markers and lumber tallymen to see that the mill numbers coincide. With all forms numbered prior to use and with a continuous repetition of five consecutive final digits on both even and odd sides, there will be ample safeguard against mixups provided the deck scaler is constantly on the alert for logs kicked ahead out of their turn. Even though a log jumps ahead one or two places without being detected by the scaler, there will be species, length, grade and volume checks between scale sheets and green chain tally sheets which will in most cases enable ready correlation simply by inspection of the data. The board marker is the key man and he must realize fully at the outset that proper correlation between logs and lumber is about 99% dependent on his marking efficiency.

The man in charge will relieve each member of the study crew, except the graders, twice each shift. The graders will be relieved by a regular company grader for a short period during each half shift.

Miscellaneous Mill Study Data

The man in charge of each shift will accumulate figures from time to time, during short periods, which will yield information concerning the following miscellany:

1. Labor involved in unloading cars at the pond especially to see if there is any difference chargeable to difference in average diameter of the load. The unloading of the cars from the study area should be timed for this purpose, recording car number and total time.

2. Labor involved in recovering sinker logs and the comparative proportion of sinker logs by species and size classes.

3. Comparative time required for bucking logs of different diameters on the log deck.

4. Sizes and species of slabs, edgings, and trims salvaged for lath, car strips, etc., labor involved, and yield of merchantable by-products.

5. Actual thicknesses and widths of green lumber as cut to produce the standard dry thicknesses and widths specified in the grading rules.

6. Comparative labor required for pulling a thousand feet of each species from the green chain (if possible).

All of the foregoing will be recorded on ordinary notebook sheets.

Seasoning Depreciation-Dry Kiln

Four to six days following the completion of the mill scale study will be devoted to the inspection of kiln dried lumber grade marked on the green chain by the study crew graders. Occasional cribs may be inspected while the mill study is in progress if opportunity offers.

An association grader and a tallyman are required for this work. Possibly an additional crew of one tallyman and a company grader will also participate in the kiln degrade study if a larger volume of lumber than one man can inspect during the allotted period is shown to be necessary to insure truly representative average results.

M-7

SEASONING DEPRECIATION

| Sp. | Size | | Grades | | Pile / Kiln | | | | | | | In | | | | Out | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | GRADE | | CAUSE OF SEASONING | | | | | | | | | | | | |
| | | | 1 | 2 | 1 | Bd. | DEGRADE | | | | | | | TRIM | RIP | 2 | |
| Sp. | W. | L. | Gn. | Gn. | Dry | Ft. | Ch. | Cp. | Kn. | Sp. | St. | Wp. | Misc. | lf. | bf. | In. | bf. | Dr. Gr. | Bd. Ft. |
| | | | | | | | | | | | | | | | | | | | |

The headings on Form M-7, with the following explanations and instructions, will indicate how the re-inspection is to be conducted and the information which will be made available.

1. Enter the species, sizes, and grades contained in the crib to be inspected at the top of the sheet, together with the kiln number, date placed in the kiln and the date removed.

2. A species column is provided at the left for use in case the crib contains more than one species. Thickness should be the same for all boards in any one crib except, perhaps, for an occasional thicker or thinner piece mixed in accidentally. Ordinarily, therefore, the grader will need to call only the width and length.

3. Record the original grade as shown by the green chain grade mark under "1 - Gn". If it is evident that this original grade was incorrect, show in what grade the piece should have been placed under "2 - Gn". The results shown in these two columns will be an index of the accuracy attained in green chain grading.

4. Under "1 - Dry" show the shipping grade of the dry board just as it comes from the kiln. Write in the grade symbol even though it is the same as the green grade.

5. If degraded during the drying process, show the cause of degrade or the combination of causes, by making the proper notations under "CAUSE OF SEASONING DEGRADE". The sub-headings stand for the following:

Ch - Check
cp - Cup
Kn - Knots
Sp - Split
St - Stain
Wp - Warp
Misc - Other defects, such as KB (kiln burn)

A complete list of symbols will be prepared for reference use by the tallyman. A few will be noted here to illustrate the system. Under "Ch", "S" denotes surface check and "E" denotes end check. Under "Kn", "Sp" denotes split knots, "L" denotes loosened knots. Under "St", "K" means kiln brown stain.

6. If the grader marks the board for trimming or ripping, write in the linear feet trimmed or the number of inches ripped. If the trims and edgings are suitable for other uses, such as box shook or moulding, place a small check mark in upper, right corner of the space in which the linear feet or inches are written.

7. Record the final grade of the ripped or trimmed board under "2 - Dr Gr".

8. When a board is trimmed or ripped without showing any seasoning degrade, record in the same manner under "Trim" or "Rip" as described above. When this occurs, "2 Dr Gr" should always be higher than "1 Dry" grade, otherwise there would be no object in the re-cutting.

9. When a board is ripped to produce two merchantable widths, e.g., a 12" board ripped to make two 6" boards, or a 14" piece ripped to make a 10" and a 4", - use two lines under "RIP" and "2 DR Gr", showing the final grade of each piece. In boards with no seasoning defects one of the narrower pieces should always be one grade or more higher than the original board before ripping.

10. The "Bd.Ft." columns can be filled in later. There will be no time, ordinarily, for such entries during the inspection work if proper attention is given to all other details.

Seasoning Depreciation - Air Yard

The company will reserve about 45 yard pile foundations for the air seasoning of lumber grade marked by the study crew graders. These need not be together. It is preferable, in fact, that each group should be reserved in the particular part of the yard where the grades and sizes to be allocated are customarily piled as regular company practice. The only precautions which should be taken are to see that the study lumber is not mixed with other material and that each reserved foundation is plainly marked "SPECIAL STUDY PILE. DO NOT TAKE DOWN".

Arrangements as to the quantity of each species-grade-size to be reserved, location of foundations and other details will be made at the mill one month in advance of the date set for the mill scale study.

The study piles will be taken down when they are thoroughly air dry (not over 15% average moisture content). Just when this will be depends on weather conditions. Probably the work can all be done during the month of September, if the mill study begins on July 8 as now planned.

An association grader and one tallyman will be assigned to the job and should be able to finish the inspection of the 45 piles in about a month. Form M-7 will be used and the same procedure will be followed as that given for the kiln depreciation study.

Compression Wood Study

Special effort will be made to obtain as complete information as possible regarding the amount and severity of compression wood in each species, especially white fir. During the seasoning inspections all splitting, warping, twisting or other defect clearly traceable to compression wood, will be designated by a "C", and in addition (at least where white fir is concerned) the per cent of the defective growth occurring in each board will be noted on the form whether or not any visible deformation has taken place. It is hoped that a technologist from the Forest Products Laboratory at Madison will be assigned for this phase of the study.

Final Examination of Cut-over Area.

After logging is completed, the study plots will be re-cruised to determine discrepancies between cutting and marking and logging damage. The maps will be revised. On the sub-plots the remaining trees 3.6 inches in diameter and over, will be numbered with permanent tags, measured and described in the usual way. Reproduction transects will be remapped and photographs repeated. Boundary stakes will be reset and the plots otherwise put in shape for permanent maintenance. After slash burning, the reproduction strips will be again examined and any changes resulting will be incorporated in the maps.

Either before or in connection with the above re-examination of the woods area, a tally will be made of all sound material, to a minimum diameter of 4 inches and a minimum length of 4 feet, left on the ground. This will be classified according to size and probable uses to which each type of material would be best adapted if utilized.

## ESTIMATED COSTS OF FIELD WORK

(Not including special studies by Forest Pathology, Entomology, Blister Rust Control, Range Management & Forest Products Laboratory)

| Subdivision of project field work | Regular personnel: All or part-time. F.S., U.C., P.L.Co. | | Temporary Assistants | | Total Cost |
|---|---|---|---|---|---|
| | No. Men | Salaries & expenses | No. Men | Salaries & expenses | |
| Plot selection, preliminary survey, Marking, log grading | 8* | $ 880 | 3 | $ 220 | $ 1100 |
| Detailed survey and mapping | 3 | 720 | 5 | 460 | 1180 |
| Felling, limbing, bucking studies, felled tree analysis | 2 | 470 | 8 | 970 | 1440 |
| Yarding, loading, transportation studies | 2 | 470 | 8 | 830 | 1300 |
| Mill scale study, pond to green chain | 9 | 1500 | 14 | 1970 | 3470 |
| Depreciation study: kiln | 1 | 70 | 1 | 70 | 140 |
| Depreciation study: yard | 1 | 330 | 1 | 310 | 640 |
| Examination cut-over area (not including silvicultural studies) | 1 | 150 | | | 150 |
| TOTAL | - | $ 4590 | - | $ 4830 | $ 9420 |
| Field forms and equipment | | | | | 250 |
| TOTAL cost to October 1, 1929 | | | | | $ 9670** |

*Includes Mr. Mason of Mason & Stevens

**Cooperative fund to be contributed by the Pickering Lumber Company will be $1500 (possibly more). Value of contributions to be made by other agencies not segregated. Costs of computing and preparation of final report will be in the neighborhood of $5000.